

AMENDMENTS TO THE CLAIMS

1-56. (Canceled).

57. (Original) A method of reducing the concentration of sulfur in gasoline produced in an FCC unit comprising contacting a catalytic cracking feedstock with an effective amount of one or more mixed metal oxide compounds prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C to produce a heat-treated mixed metal oxide compound in the form of an aqueous slurry;

(c) drying the heat-treated compound from step (b) to produce one or more shaped bodies of the mixed metal oxide compound suitable for use in the reduction of sulfur from gasoline; and

(d) optionally heat treating the shaped bodies from step (c) at a temperature of about 300°C or higher to produce one or more calcined shaped bodies of a mixed metal oxide compound.

58. (Original) The method according to claim 57, wherein the divalent metal cation in the divalent metal compound of step (a) is selected from Mg²⁺, Ca²⁺, Zn²⁺, Mn²⁺, Co²⁺, Ni²⁺, Sr²⁺, Ba²⁺, Cu²⁺ or a mixture of two or more thereof.

59. (Original) The method according to claim 57, wherein the trivalent metal cation in the trivalent metal compound of step (a) is selected from Al³⁺, Mn³⁺, Fe³⁺, Co³⁺, Ni³⁺, Cr³⁺, Ga³⁺, B³⁺, La³⁺, G³⁺, Ce³⁺, or a mixture of two or more thereof.

60. (Original) The method according to claim 57, wherein the divalent metal compound of step (a) is selected from magnesium oxide, magnesium hydroxy acetate, magnesium acetate, magnesium hydroxide, magnesium nitrate, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium chloride, magnesium aluminate, hydrous magnesium silicate, magnesium calcium silicate, or a mixture of two or more thereof.

61. (Original) The method according to claim 57, wherein the trivalent metal compound of step

(a) is selected from aluminum hydroxide hydrate, aluminum oxide, aluminum acetate, aluminum nitrate, aluminum hydroxide, aluminum carbonate, aluminum formate, aluminum chloride, hydrous aluminum silicate, aluminum calcium silicate, or a mixture of two or more thereof.

62. (Original) The method according to claim 57, wherein, in step (a), in the mixed metal oxide compounds, the ratio of the divalent metal cation to the trivalent metal cation is selected from about 1:1 to about 10:1; from about 1:1 to about 6:1; from about 1.5:1 to about 6:1; or from about 2:1 to about 5:1.

63. (Original) The method according to claim 57, further comprising a support comprising a spinel, magnesia, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium aluminate, hydrous magnesium silicate, magnesium silicate, magnesium calcium silicate, aluminum silicate, calcium silicate, alumina, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, an aluminum hydroxide compound, an aluminum-containing metal oxide compound other than alumina or an aluminum hydroxide compound, aluminum chlorhydrate, silica, silicon-containing compound other than silica, silica/alumina, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof.

64. (Original) The method according to claim 57, wherein the mixed metal oxide compounds comprise an amount selected from at least about 1 ppm, at least about 2 ppm, or at least about 5 ppm.

65. (Original) The method according to claim 57 wherein the mixed metal oxide compounds comprises about 5% or more of the inventory of the regenerator.

66. (Original) The method according to claim 57, wherein the mixed metal oxide compounds comprises about 10% or more of the inventory of the regenerator.

67-76. (Canceled).

77. (Original) A method of reducing the concentration of sulfur in gasoline produced in an FCC unit comprising contacting a catalytic cracking feedstock with an effective amount of at least one mixed metal oxide compound comprising magnesium and aluminum in a ratio of about 1:1 to

about 10:1 and having an x-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees.

78. (Original) The method according to claim 77, wherein the ratio of magnesium to aluminum is about 1:1 to about 6:1.

79. (Original) The method according to claim 77, wherein the ratio of magnesium to aluminum is about 1.8:1 to about 5:1.

80. (Original) The method according to claim 77, wherein the ratio of magnesium to aluminum is about 2:1 to about 4:1.

81. (Original) The method of claim 77, wherein the compound is a shaped body.

82. (Original) The method of claim 81, wherein the shaped body is a dried shaped body.

83. (Original) The method of claim 81, wherein the shaped body is a calcined shaped body.

84. (Original) The method of claim 77, wherein the compound comprises magnesium in an amount of about 40% or more by weight, calculated as the oxide equivalent.

85. (Original) The method of claim 77, wherein the compound further comprises at least one metallic oxidant.

86. (Original) The method of claim 85, wherein the metal in the metallic oxidant is selected from antimony, bismuth, cadmium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, germanium, gold, holmium, iridium, iron, lanthanum, lead, manganese, molybdenum, neodymium, nickel, niobium, osmium, palladium, platinum, praseodymium, promethium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silicon, silver, sulfur, tantalum, tellurium, terbium, tin, titanium, tungsten, thulium, vanadium, ytterbium, yttrium, zinc, or a mixture of two or more thereof.

87. (Original) The method of claim 77, wherein the compound further comprises a support.

88. (Original) The method of claim 87, wherein the support comprises a spinel, hydrotalcite like compound, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide,

magnesium carbonate, magnesium formate, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, aluminum hydroxide compound, aluminum-containing metal oxide compound, aluminum chlorohydrate, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof.

89. (Original) The method of claim 87, wherein the support is selected from zinc titanate, zinc aluminate, or zinc titanate/zinc aluminate.

90. (Original) The method according to claim 77, wherein the at least one mixed metal oxide compound comprises an amount selected from at least about 1 ppm, at least about 2 ppm, or at least about 5 ppm.

91. (Original) The method according to claim 77 wherein the at least one mixed metal oxide compound comprises about 5% or more of the inventory of the regenerator.

92. (Original) The method according to claim 77, wherein the at least one mixed metal oxide compound comprises about 10% or more of the inventory of the regenerator.

93. (Withdrawn) A gasoline reduction additive comprising at least one mixed metal oxide compound comprising magnesium and aluminum in a ratio of about 1:1 to about 10:1 and having an x-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees.

94. (Withdrawn) The additive according to claim 93, wherein the magnesium and aluminum ratio is about 1:1 to about 6:1.

95. (Withdrawn) The additive according to claim 93, wherein the magnesium to aluminum ratio is about 1:1 to about 5:1.

96. (Withdrawn) The additive according to claim 93, wherein the magnesium and aluminum ratio is about 2:1 to about 5:1.

97. (Withdrawn) The additive according to claim 93, wherein the mixed metal oxide compound comprises a solid solution in the form of one or more of a slurry, dried shaped bodies, or calcined shaped bodies.

98. (Withdrawn) The additive according to claim 93, further comprising a support comprising a spinel, magnesia, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium aluminate, hydrous magnesium silicate, magnesium silicate, magnesium calcium silicate, aluminum silicate, boria, calcium silicate, alumina, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, aluminum hydroxide compound, aluminum chlorohydrate, silica, silicon-containing compounds other than silicas, silica/alumina, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof.

99. (Withdrawn) The additive according to claim 98, wherein the clays are selected from halloysite, rectorite, hectorite, montmorillonite, synthetic montmorillonite, sepiolite, activated sepeolite, kaolin, kieselguhr, celite, bastnasite, or a mixture of two or more thereof.

100. (Original) A method for reducing the concentration of sulfur in gasoline produced in an FCC unit comprising contacting a catalytic cracking feedstock with

(i) an effective amount of shaped bodies comprising a mixed metal oxide solid solution comprising magnesium and aluminum in a ratio of about 1:1 to about 10:1 and having an X-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees,

(ii) a support comprising a spinel, magnesia, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium aluminate, hydrous magnesium silicate, magnesium silicate, magnesium calcium silicate, aluminum silicate, calcium silicate, alumina, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, an aluminum hydroxide compounds, an aluminum-containing metal oxide compound other than alumina or an aluminum hydroxide compound, aluminum chlorohydrate, silica, silicon-containing compound other than silica, silica/alumina, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof; and

(iii) at least one metallic oxidant selected from antimony, bismuth, cadmium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, germanium, gold, holmium, iridium, iron, lanthanum, lead, manganese, molybdenum, neodymium, nickel, niobium, osmium, palladium, platinum, praseodymium, promethium, rhenium, rhodium,

ruthenium, samarium, scandium, selenium, silicon, silver, sulfur, tantalum, tellurium, terbium, tin, titanium, tungsten, thulium, vanadium, ytterbium, yttrium, zinc, or a mixture of two or more thereof.

101. (Original) The method according to claim 100, further comprising a hydrotalcite like compound.

102. (Original) The method according to claim 101, wherein the hydrotalcite like compound is a calcined hydrotalcite like compound.

103. (Original) The method according to claim 101, wherein the hydrotalcite like compound is a collapsed hydrotalcite like compound.

104. (Original) A method for reducing gasoline sulfur comprising contacting a catalytic cracking feedstock with (i) a mixed metal oxide compound comprising magnesium and aluminum and having an X-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1, and (ii) about 1 wt% to about 75 wt% of a hydrotalcite like compound.

105. (Original) The method of claim 104, where the compound is heated prior to contacting the compound with the feedstock.

106. (Original) The method of claim 104, wherein the ratio of magnesium to aluminum is about 1.8:1 to about 5:1.

107. (Original) The method of claim 104, wherein the ratio of magnesium to aluminum is about 1:1 to about 5:1.

108. (Original) The method of claim 104, wherein the ratio of magnesium to aluminum is about 2:1 to about 4:1.

109. (Original) The method of claim 104, wherein the compound is a shaped body.

110. (Original) The method of claim 109, wherein the shaped body is a dried shaped body.

111. (Original) The method of claim 109, wherein the shaped body is a calcined shaped body.
112. (Original) The method of claim 104, wherein the compound comprises magnesium in an amount of about 40% or more by weight, calculated as the oxide equivalent.
113. (Original) The method of claim 104, wherein the compound comprises (i) about 99 wt% to about 50 wt% of a compound comprising magnesium and aluminum and having an X-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 6:1, and (ii) about 1 wt% to about 50 wt% of a hydrotalcite like compound.
114. (Original) The method according to claim 113, wherein the compound comprises (i) about 99 wt% to about 75 wt% of a compound comprising magnesium and aluminum and having an X-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 6:1, and (ii) about 1 wt% to about 25 wt% of a hydrotalcite like compound.
115. (Original) The method according to claim 114, wherein the compound comprises (i) about 95 wt% to about 75 wt% of a compound comprising magnesium and aluminum and having an X-ray diffraction pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 6:1, and (ii) about 5 wt% to about 25 wt% of a hydrotalcite like compound.
116. (Original) The method according to claim 104, wherein the compound further comprises at least one metallic oxidant.
117. (Original) The method according to claim 116, wherein the metal in the metallic oxidant is antimony, bismuth, cadmium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, germanium, gold, holmium, iridium, iron, lanthanum, lead, manganese, molybdenum, neodymium, nickel, niobium, osmium, palladium, platinum, praseodymium, promethium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silicon, silver, sulfur, tantalum, tellurium, terbium, tin, titanium, tungsten, thulium, vanadium, ytterbium,

yttrium, zinc, or a mixture of two or more thereof.

118. (Original) The method according to claim 104, wherein the compound further comprises a support.

119. (Original) The method according to claim 118, wherein the support comprises a spinel, hydrotalcite like compound, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, aluminum hydroxide compound, aluminum-containing metal oxide compound, aluminum chlorohydrate, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof.

120. (Original) The method according to claim 119, wherein the support comprises zinc titanate, zinc aluminate, or zinc titanate/zinc aluminate.

121. (Withdrawn) A gasoline reduction additive comprising at least one compound having an x-ray diffraction pattern displaying at least a reflection at a two theta peak position of about 11 degrees, 23 degrees and 34 degrees and comprising (i) at least one metallic oxidant selected from antimony, bismuth, cadmium, cerium, chromium, cobalt, copper, dysprosium, erbium, europium, gadolinium, germanium, gold, holmium, iridium, iron, lanthanum, lead, manganese, molybdenum, neodymium, nickel, niobium, osmium, palladium, platinum, praseodymium, promethium, rhenium, rhodium, ruthenium, samarium, scandium, selenium, silicon, silver, sulfur, tantalum, tellurium, terbium, tin, titanium, tungsten, thulium, vanadium, ytterbium, yttrium, zinc, or a mixture of two or more thereof, and (ii) a support comprising spinels, magnesia, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium aluminate, hydrous magnesium silicate, magnesium silicate, magnesium calcium silicate, aluminum silicate, calcium silicate, alumina, aluminum titanate, zinc titanate, aluminum zirconate, calcium oxide, calcium aluminate, aluminum nitrohydrate, an aluminum hydroxide compounds, an aluminum-containing metal oxide compound other than alumina or an aluminum hydroxide compound, aluminum chlorohydrate, silica, silicon-containing compound other than silica, silica/alumina, titania, zirconia, clay, clay phosphate material, zeolite, or a mixture of two or more thereof.

122. (Withdrawn) A method for reducing bottoms produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound.

123. (Withdrawn) A method for increasing catalytic conversion by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound.

124. (Withdrawn) A method for increasing liquid petroleum gas produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound.

125. (Withdrawn) A method for increasing the quantity of gasoline produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound.

126. (Withdrawn) A method for decreasing light cycle oil produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound.

127. (Withdrawn) A method for reducing bottoms produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C;

(c) drying the heat-treated compound from step (a) or step (b) to produce one or more shaped bodies suitable for use in the reduction of sulfur from gasoline;

(d) heat treating the shaped bodies from step (c) at a temperature of about 300°C or higher to produce one or more calcined shaped bodies;

(e) hydrating the calcined shaped bodies from step (d) to produce a hydrotalcite like compound; and

(f) optionally heating the hydrotalcite like compound to remove substantially all of the interstitial water and/or anions to produce a collapsed hydrotalcite like compound.

128. (Withdrawn) A method for increasing catalytic conversion by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C;

(c) drying the heat-treated compound from step (a) or step (b) to produce one or more shaped bodies suitable for use in the reduction of sulfur from gasoline;

(d) heat treating the shaped bodies from step (c) at a temperature of about 300°C or higher to produce one or more calcined shaped bodies;

(e) hydrating the calcined shaped bodies from step (d) to produce a hydrotalcite like compound; and

(f) optionally heating the hydrotalcite like compound to remove substantially all of the interstitial water and/or anions to produce a collapsed hydrotalcite like compound.

129. (Withdrawn) A method for increasing liquid petroleum gas produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C;

(c) drying the heat-treated compound from step (a) or step (b) to produce one or more shaped bodies suitable for use in the reduction of sulfur from gasoline;

(d) heat treating the shaped bodies from step (c) at a temperature of about 300°C or

higher to produce one or more calcined shaped bodies;

(e) hydrating the calcined shaped bodies from step (d) to produce a hydrotalcite like compound; and

(f) optionally heating the hydrotalcite like compound to remove substantially all of the interstitial water and/or anions to produce a collapsed hydrotalcite like compound.

130. (Withdrawn) A method for increasing the quantity of gasoline produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C;

(c) drying the heat-treated compound from step (a) or step (b) to produce one or more shaped bodies suitable for use in the reduction of sulfur from gasoline;

(d) heat treating the shaped bodies from step (c) at a temperature of about 300°C or higher to produce one or more calcined shaped bodies;

(e) hydrating the calcined shaped bodies from step (d) to produce a hydrotalcite like compound; and

(f) optionally heating the hydrotalcite like compound to remove substantially all of the interstitial water and/or anions to produce a collapsed hydrotalcite like compound.

131. (Withdrawn) A method for decreasing light cycle oil produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of one or more shaped bodies, comprising a hydrotalcite like compound prepared by a process comprising:

(a) reacting an aqueous mixture comprising at least one divalent metal compound and at least one trivalent metal compound to produce a mixed metal oxide compound in the form of an aqueous slurry;

(b) optionally heat treating the mixed metal oxide compound from step (a) at a temperature up to about 225°C;

(c) drying the heat-treated compound from step (a) or step (b) to produce one or more

shaped bodies suitable for use in the reduction of sulfur from gasoline;

(d) heat treating the shaped bodies from step (c) at a temperature of about 300°C or higher to produce one or more calcined shaped bodies;

(e) hydrating the calcined shaped bodies from step (d) to produce a hydrotalcite like compound; and

(f) optionally heating the hydrotalcite like compound to remove substantially all of the interstitial water and/or anions to produce a collapsed hydrotalcite like compound.

132. (Withdrawn) A method for reducing bottoms produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of a mixed metal oxide compound comprising magnesium and aluminum and having an XRD pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1.

133. (Withdrawn) A method for increasing catalytic conversion by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of a mixed metal oxide compound comprising magnesium and aluminum and having an XRD pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1.

134. (Withdrawn) A method for increasing the quantity of gasoline produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of a mixed metal oxide compound comprising magnesium and aluminum and having an XRD pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1.

135. (Withdrawn) A method for increasing liquid petroleum gas produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of a mixed metal oxide compound comprising magnesium and aluminum and having an XRD pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1.

136. (Withdrawn) A method for decreasing light cycle oil produced by a catalytic cracking process comprising contacting a catalytic cracking feedstock with an effective amount of a mixed metal oxide compound comprising magnesium and aluminum and having an XRD pattern displaying at least a reflection at a two theta peak position at about 43 degrees and about 62 degrees, wherein the ratio of magnesium to aluminum in the compound is from about 1:1 to about 10:1.